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CURRENT SERIAL RECORDS

EXTENT AND COST OF USING CHEMICALS IN COTTON PRODUCTION

SELECTED AREAS, 1961

U. S. DEPARTMENT OF AGRICULTURE

Economic Research Service

Farm Production Economics Division

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SUMMARY

Insecticides, fertilizer, herbicides, and defoliants are becoming increasingly important in producing cotton in the United States. To aid in determining the extent cotton growers use these chemicals, and the costs, the Economic Research Service conducted a survey in the summer of 1962. Information on practices used in 1961 was collected from about 2,200 farmers in 15 areas where boll weevils caused significant damage. Totals and averages for all areas as well as data for each area are presented.

Insecticides. About four-fifths of the cotton acreage on the sample farms was treated one or more times. The proportion treated varied from about 40 percent in the Brown Loam area of Tennessee to nearly 100 percent in the Delta areas. The number of applications also varied among areas and averaged 7.2 treatments for all areas. The cost per acre treated ranged from about \$4 in the Brown Loam area to about \$30 in Presidio County, Tex. For each acre treated, the cost averaged \$8.10 for materials and \$4.72 for application - a total of \$12.82. This is equivalent to a total of \$10.38 per planted acre or about \$12 per bale.

Fertilizer. Except in three Texas areas, essentially all of the cotton acreage was fertilized. The quantity used averaged slightly over 100 pounds of plant nutrients per acre planted to cotton. The average cost was approximately \$10 per acre. If the three Texas areas, where only small quantities of fertilizer are used, are excluded, the average for the remaining areas is about 144 pounds of plant nutrients per acre planted to cotton and the cost is slightly over \$14 per acre.

Herbicides. About 35 percent of the cotton acreage on the sample farms was treated with pre-emergence herbicides. This proportion varied from none in the three Texas areas to 77 percent on large farms in the Delta area of Louisiana. The average cost, including application, was slightly over \$3 per acre treated.

The use of post-emergence herbicides was confined almost exclusively to the Delta areas and primarily to large farms in these areas. For the three Delta areas, approximately one-sixth of the acreage planted to cotton was treated at a cost of slightly over \$3 per acre.

Defoliants. The use of chemical defoliants on cotton is closely related to extent of mechanical harvesting. In the Delta areas and in the Blackland area of Texas, a high proportion of the acreage is treated with defoliants. A high percentage of the cotton is mechanically harvested in these areas. In the Piedmont areas of the Southeast, a very small proportion of the cotton is harvested mechanically and essentially no chemical defoliants are used.

About two-fifths of the cotton acreage on the survey farms was defoliated. The cost of materials and their application averaged about \$2.50 per treated acre.

All Chemicals. The estimated total costs of all specified chemicals, per acre of cotton, averaged \$17.74 for the materials plus \$5.30 for their application or a total of about \$23. The average yield of lint was about 410 pounds per acre planted to cotton. Thus, the average costs were equivalent to 5.6 cents per pound of lint.

EXTENT AND COST OF USING CHEMICALS IN COTTON PRODUCTION
SELECTED AREAS, 1961

by

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INTRODUCTION

Significant changes are taking place in cotton production practices. The adoption of a particular technique may cause the need for modification of other practices. For example, heavier application of fertilizer and supplemental irrigation have raised the level of potential yields. In many instances, these practices are conducive to heavier insect populations, particularly boll weevil. This has increased the need for insect control and magnified its difficulty. There is need for information pertaining to the extent of use of insecticides and other chemicals in cotton production.

In recent years use of insecticides has been increasing. There is always the possibility that insecticides in large quantities could be harmful to people or livestock in the immediate area. When used in very large amounts these insecticides and their residues could possibly contaminate nearby streams and the local water supply. Persons applying insecticides should always follow the instructions on the container very carefully.

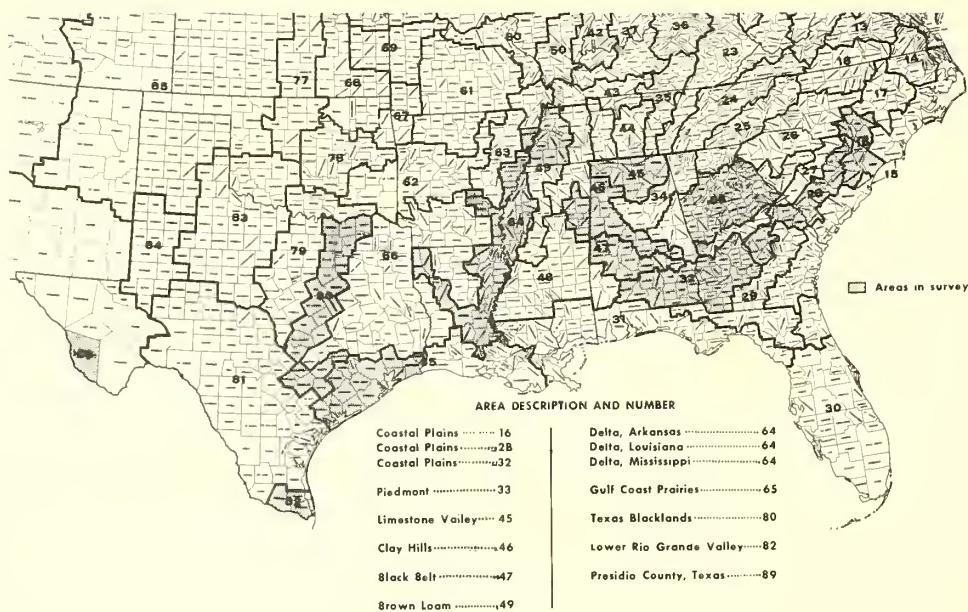
During the summer of 1962, the Economic Research Service conducted a survey among cotton producers in several areas. The major purposes of this survey were: (1) To determine, for selected areas, the proportion of the cotton acreage on which insect control practices were used and to ascertain the kind and quantity of materials used, the method of application, and to develop estimates of costs of insecticides and their application; (2) to obtain similar information for pre-emergence and post-emergence herbicides, defoliants, and fertilizer.

PROCEDURE

The survey was conducted in 15 cotton-producing areas where boll weevils cause considerable damage (fig. 1). In each area, except Presidio County, Tex., information was obtained by personal interview from about 150 farmers. In Presidio County, essentially all cotton producers were interviewed.

A random sample of farmers was selected in each area to assure proper geographic distribution within the area. The sample was designed to provide about 50 records for each of the three sizes of farm groups in each area; small, medium, and large. An explanation of the size groupings is shown in table 1. The percentage distribution of the total acreage of cotton in each production area is shown in table 2. These percentages were used as weights in summarizing data obtained from the survey for respective production areas and for all areas combined.

AREAS IN SURVEY
 Selected Cotton Producing Areas in Which Insecticides Were Used



U. S. DEPARTMENT OF AGRICULTURE

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Figure 1

Table 1. --Acres planted to cotton on farms designated small, medium, and large, by area, 1961

| Area and number | Size of farm | | |
|--|--------------|--------------|--------------|
| | Small | Medium | Large |
| | Acres | Acres | Acres |
| Piedmont ----- 33 ----- | | | |
| Clay Hills----- 46 ----- | 3 to 9.9 | 10.0 to 29.9 | 30 and over |
| Black Belt ----- 47 ----- | | | |
| Coastal Plains----- 16 ----- | | | |
| Coastal Plains----- 28 ----- | 5 to 19.9 | 20.0 to 49.9 | 50 and over |
| Coastal Plains----- 32 ----- | | | |
| Limestone Valley ----- 45 ----- | | | |
| Brown Loam ----- 49 ----- | | | |
| Gulf Coastal Prairie --- 65 ----- | | | |
| Texas Blacklands ----- 80 ----- | | | |
| Delta, Ark. ----- 64 ----- | 5 to 19.9 | 20.0 to 99.9 | 100 and over |
| Delta, La. ----- 64 ----- | | | |
| Delta, Miss. ----- 64 ----- | | | |
| Lower Rio Grande Valley ----- 82 ----- | | | |
| Presidio County, Tex. -- 89 ----- | | | |

Table 2. --Distribution of cotton acreage, by size of farm, by area, 1961

| Area and number | Size of farm | | |
|------------------------------------|--------------|---------|---------|
| | Small | Medium | Large |
| | Percent | Percent | Percent |
| Coastal Plains----- 16 -----: | 42 | 29 | 29 |
| Coastal Plains----- 28 -----: | 31 | 31 | 38 |
| Coastal Plains----- 32 -----: | 40 | 30 | 30 |
| Piedmont ----- 33 -----: | 29 | 33 | 38 |
| Limestone Valley ----- 45 -----: | 34 | 39 | 27 |
| Clay Hills----- 46 -----: | 32 | 49 | 19 |
| Black Belt ----- 47 -----: | 22 | 37 | 41 |
| Brown Loam ----- 49 -----: | 29 | 44 | 27 |
| Delta, Ark. ----- 64 -----: | 10 | 27 | 63 |
| Delta, La. ----- 64 -----: | 22 | 40 | 38 |
| Delta, Miss. ----- 64 -----: | 4 | 14 | 82 |
| Gulf Coast Prairie ----- 65 -----: | 15 | 33 | 52 |
| Texas Blacklands ----- 80 -----: | 10 | 27 | 63 |
| Lower Rio Grande | : | | |
| Valley----- 82 -----: | 18 | 28 | 54 |
| Presidio County, Tex. -- 89 -----: | 18 | 34 | 48 |
| | : | | |

Each farmer interviewed was asked whether insect control practices were used on his cotton in 1961, and if so, the number of acres covered, the kind of insecticides used, the number of applications, the quantity used, the method of application, the costs of insecticides, and the cost of application. Similar information was obtained for pre-emergence and post-emergence herbicides, defoliants, and fertilizer. Thus, a rather complete inventory of the chemicals used in cotton production is available for the areas covered by the survey.

This publication contains summaries of the more important results of the analysis of the information obtained in the survey. Data are presented by cotton production areas and in some instances by size of farm.

INSECT CONTROL PRACTICES

Acreage Treated

In 1961, slightly over four-fifths of the total cotton acreage in the survey areas was treated one or more times with insecticides. The proportion of the acreage treated varied considerably among areas and by size of farm within an area (table 3). In Presidio County, Tex., all of the cotton was treated and essentially all was treated in the Delta areas of Louisiana and Mississippi and in the Georgia-Alabama Coastal Plains Area 32. A much smaller percentage of acreage was treated in the Brown Loam area of Tennessee and in the Limestone Valley areas, which are on the northern edge of the Cotton Belt.

Table 3.--Percentage of cotton acreage on which insecticides were used, by size of farm, by area, 1961

| Area and number | Acres treated | | | | |
|-------------------------------|---------------|---------|---------|------------------|-----|
| | Size of farm | | | Weighted average | |
| | Small | Medium | Large | | |
| | Percent | Percent | Percent | Percent | |
| Coastal Plains----- | 16 ----- : | 71 | 78 | 77 | 75 |
| Coastal Plains----- | 28 ----- : | 86 | 87 | 94 | 89 |
| Coastal Plains----- | 32 ----- : | 96 | 98 | 99 | 98 |
| Piedmont ----- | 33 ----- : | 86 | 99 | 99 | 95 |
| Limestone Valley ----- | 45 ----- : | 45 | 72 | 82 | 65 |
| Clay Hills ----- | 46 ----- : | 80 | 87 | 89 | 85 |
| Black Belt ----- | 47 ----- : | 54 | 77 | 89 | 77 |
| Brown Loam ----- | 49 ----- : | 41 | 29 | 65 | 42 |
| Delta, Miss. ----- | 64 ----- : | 82 | 95 | 99 | 98 |
| Delta, La. ----- | 64 ----- : | 96 | 98 | 100 | 98 |
| Delta, Ark. ----- | 64 ----- : | 44 | 64 | 85 | 75 |
| Gulf Coast Prairie ----- | 65 ----- : | 60 | 73 | 96 | 83 |
| Texas Blacklands ----- | 80 ----- : | 35 | 48 | 87 | 71 |
| Lower Rio Grande Valley ----- | 82 ----- : | 87 | 99 | 94 | 94 |
| Presidio County, Tex. ----- | 89 ----- : | 100 | 100 | 100 | 100 |
| Weighted average ----- | : | --- | --- | --- | 81 |

Generally, there is a close relationship between size of farm and proportion of acreage treated. In all areas, a considerably higher proportion of the acreage on large farms was treated than on small farms. And in all areas except the Brown Loam area of Tennessee, a higher proportion of the acreage of medium-sized farms was treated than on small farms. A comparison of the proportion of the acreage treated on small farms and the weighted average percentage of the treated acreage in the Delta Area of Mississippi illustrates the heavy weighting of large farms. About 82 percent of the cotton acreage in this area is on large farms (table 2).

Insecticide Applications

The number of applications of insecticides varied among areas and by size of farm, with the largest average number of applications, 10 to 12, in the Delta areas of Louisiana and Mississippi, the Coastal Plains of Alabama and Georgia, and Presidio County, Tex. The smallest number of applications, about 4, was in the Blackland and Gulf Coast Prairie areas of Texas and in the Brown Loam area of Tennessee. In most areas, the average number of applications increased as the size of the farm increased. The weighted average number of applications was 7.2 for the survey area (table 4).

Method of Application

Insecticides were applied as sprays and as dusts. Airplanes, ground equipment, and self-propelled, high-clearance machines were used to apply each of these types of materials. Sprays were used on about three-fourths and dusts on about one-fourth of the acreage treated. Airplanes were used to apply materials on about 22 percent

Table 4.--Average number of applications of insecticides on treated acres, by size of farm, by area, 1961

| Area and number | Acres | | | | | Weighted average |
|--|----------------------|--------|--------|--------|--------|------------------|
| | planted to cotton | Small | Medium | Large | | |
| | 1,000 acres | Number | Number | Number | Number | |
| Coastal Plains---16-----: | 165 | 5.3 | 7.1 | 7.6 | 6.5 | |
| Coastal Plains---28-----: | 336 | 5.4 | 6.9 | 8.7 | 7.1 | |
| Coastal Plains---32-----: | 285 | 10.8 | 9.0 | 10.8 | 10.3 | |
| Piedmont -----33-----: | 152 | 5.9 | 7.4 | 6.3 | 6.5 | |
| Limestone | | | | | | |
| Valley-----45-----: | 277 | 6.4 | 5.2 | 6.3 | 5.9 | |
| Clay Hills-----46-----: | 174 | 6.4 | 8.3 | 11.0 | 8.2 | |
| Black Belt -----47-----: | 171 | 6.0 | 5.8 | 7.3 | 6.5 | |
| Brown Loam ----49-----: | 354 | 3.1 | 3.9 | 5.8 | 4.2 | |
| Delta, Miss. ----64-----: | 720 | 6.9 | 8.5 | 10.4 | 10.0 | |
| Delta, La. -----64-----: | 379 | 10.0 | 11.0 | 13.9 | 11.9 | |
| Delta, Ark. -----64-----: | 663 | 5.2 | 6.2 | 7.0 | 6.6 | |
| Gulf Coast | | | | | | |
| Prairie -----65-----: | 221 | 2.4 | 3.8 | 4.3 | 3.9 | |
| Texas Blacklands 80-----: | 1,178 | 4.2 | 3.4 | 3.5 | 3.5 | |
| Lower Rio | | | | | | |
| Grande Valley--82-----: | 422 | 4.9 | 7.5 | 9.8 | 8.3 | |
| Presidio County, Tex. -----89-----: | 4 | 9.8 | 12.6 | 12.4 | 12.0 | |
| Total ----- | 5,501 | --- | --- | --- | --- | --- |
| Weighted average ---: | --- | --- | --- | --- | --- | 7.2 |

of the acreage treated, self-propelled, high-clearance machines on 17 percent, and ground equipment, usually tractor powered, on 61 percent (table 5). The use of sprays was considerably above the average in the Delta, the Blackland, and Lower Rio Grande Valley areas. The use of airplanes in the Delta was considerably above the average for all areas. There appears to be an association between size of farm and the use of airplanes, with planes being used more on the larger farms. A large proportion of the operators of small cotton farms use ground equipment, much of which is hired on a custom basis.

Table 5.--Percentage of cotton acreage treated, by type of equipment used to apply insecticides, by area, 1961

| Area and number | Kind of material and method of application | | | | | |
|--|--|---------|---------|---------|---------|---------|
| | Spray | | | Dust | | |
| | Percent | Percent | Percent | Percent | Percent | Percent |
| Coastal Plains----16 ----- | 8 | 17 | 46 | 71 | 1 | 0 |
| Coastal Plains----28 ----- | 2 | 10 | 29 | 41 | 5 | 2 |
| Coastal Plains----32 ----- | 1 | 12 | 21 | 34 | 9 | 1 |
| Piedmont -----33 ----- | 0 | 0 | 8 | 8 | 0 | 0 |
| Limestone Valley -45 ----- | 4 | 8 | 10 | 22 | 10 | 0 |
| Clay Hills-----46 ----- | 4 | 2 | 37 | 43 | 2 | 1/ |
| Black Belt -----47 ----- | 30 | 12 | 14 | 56 | 1 | 0 |
| Brown Loam -----49 ----- | 4 | 13 | 39 | 56 | 1 | 0 |
| Delta, Miss. -----64 ----- | 29 | 45 | 24 | 98 | 1 | 0 |
| Delta, La. -----64 ----- | 43 | 15 | 28 | 86 | 3 | 0 |
| Delta, Ark. -----64 ----- | 55 | 27 | 10 | 92 | 1 | 0 |
| Gulf Coast | | | | | | |
| Prairie -----65 ----- | 6 | 0 | 61 | 67 | 2 | 1/ |
| Texas Blacklands -80 ----- | 5 | 13 | 72 | 90 | 0 | 0 |
| Lower Rio | | | | | | |
| Grande Valley---82 ----- | 22 | 4 | 67 | 93 | 4 | 0 |
| Presidio County, Tex. -----89 ----- | 24 | 0 | 2 | 26 | 58 | 0 |
| Weighted average ---: | 19 | 17 | 38 | 74 | 3 | 1/ |
| | | | | | | 23 |
| | | | | | | 26 |
| | | | | | | Total |

1/ Less than 0.5 percent.

Cost of Insecticides and Their Application

Data were obtained on the quantities and prices of each insecticide used by each farmer interviewed. However, because of the differences in the kinds of materials and variations in the number of applications, it is not feasible to derive estimates of average quantities of insecticide materials used per acre by areas or by size of farm. In fact, average cost per acre appears to be the best means of presenting an overall summary of insect control measures.

The estimated cost of insecticides varied from a low of about \$4 per acre treated in the Brown Loam area of Tennessee to nearly \$30 per acre in Presidio County, Tex. The estimated weighted average cost per acre treated was \$8.10 (table 6). The estimated cost of applying insecticide averaged \$4.72 per acre treated. Thus, the estimated total cost of insecticides and their application for all areas averaged \$12.82 per acre treated. This is equivalent to \$10.38 per planted acre or about \$12 per bale of cotton produced.

In general, the number of applications is the most important factor affecting the cost per acre. However, the kind of insecticide and the rate of application are also important. In the Lower Rio Grande Valley, where boll worms as well as boll weevils are important, heavier rates of application of some insecticides are used. The differences in cost of application are related primarily to the number of applications. But, in those areas where airplanes were used on a large proportion of the acreage, the costs tended to be higher.

Types of Insecticides

The insecticides used were grouped into four classes of toxicants: (1) chlorinated hydrocarbons, (2) organic phosphates, (3) carbamates, and (4) inorganics. Table 7 shows estimates of the percentage distribution of the cotton acreage by major classes of toxicants. A combination of toxicants may mean the use of more than one class of toxicant in the same application or in different applications at different times, but on the same field of cotton.

The hydrocarbons alone or in combination with organic phosphates were used on 87 percent of the acreage treated. The "all other classes" (table 7) were composed primarily of carbamates used in combination with chlorinated hydrocarbons or organic phosphates. In the Piedmont area, a considerable amount of calcium arsenate was used.

The costs of insecticides in 1961 were slightly less than usual for the entire survey area. In the Delta and other mid-South areas, the data indicated less than average insect infestation in 1961. In the Southeastern area, the infestation was reported as about average. But, in the Texas areas infestation was estimated to be heavier than usual.

The effectiveness of insect control methods used by farmers is almost impossible to measure except in a very general way. Likewise, it is difficult to measure the total loss in yield caused by insects.

Table 6.--Cost of cotton insect control practices, by area, 1961

| Area and number | Acres planted to cotton | Acres treated | Material | Cost per treated acre | | Total cost of material and application | |
|--------------------------------|-------------------------|---------------|----------|-----------------------|------------------|--|----------|
| | | | | Application | Per acre treated | Per acre planted | Per bale |
| | | | | | | | |
| | 1,000 acres | Percent | | Dollars | Dollars | Dollars | Dollars |
| Coastal Plains-----16 | 165 | 75 | 7.84 | 3.44 | 11.28 | 8.43 | 11.09 |
| Coastal Plains-----28 | 336 | 89 | 9.57 | 3.65 | 13.22 | 11.82 | 14.36 |
| Coastal Plains-----32 | 285 | 98 | 13.67 | 5.41 | 19.08 | 18.60 | 22.38 |
| Piedmont-----33 | 152 | 95 | 11.19 | 3.10 | 14.29 | 13.56 | 15.91 |
| Limestone Valley-----45 | 277 | 65 | 8.03 | 3.89 | 11.92 | 7.79 | 8.86 |
| Clay Hills-----46 | 174 | 85 | 8.74 | 5.22 | 13.96 | 11.87 | 12.10 |
| Black Belt -----47 | 171 | 77 | 7.90 | 3.66 | 11.56 | 8.91 | 9.18 |
| Brown Loam -----49 | 354 | 42 | 4.03 | 3.77 | 7.80 | 3.27 | 2.52 |
| Delta, Miss. -----64 | 720 | 98 | 8.23 | 5.90 | 14.13 | 13.83 | 10.92 |
| Delta, La. -----64 | 379 | 98 | 8.11 | 8.49 | 16.60 | 16.32 | 16.25 |
| Delta, Ark. -----64 | 663 | 75 | 5.80 | 4.57 | 10.37 | 7.80 | 6.41 |
| Gulf Coast Prairie-----65 | 221 | 83 | 4.20 | 3.23 | 7.43 | 6.14 | 14.03 |
| Texas Blacklands -----80 | 1,178 | 71 | 3.99 | 2.66 | 6.65 | 4.73 | 14.10 |
| Lower Rio Grande Valley-----82 | 422 | 94 | 16.31 | 6.49 | 22.80 | 21.46 | 28.69 |
| Presidio County, Tex. -----89 | 4 | 100 | 29.63 | 9.15 | 38.78 | 38.78 | 19.45 |
| Total ----- | 5,501 | --- | --- | --- | --- | --- | --- |
| Weighted average ----- | --- | 81 | 8.10 | 4.72 | 12.82 | 10.38 | 12.17 |

Table 7.--Distribution of cotton acres treated, by class of toxicant, by area, 1961

| Area and number | Chlorinated hydro-carbon | Organic phosphate | Combination 1 and 2 | All other classes | Total all classes |
|-------------------------------------|--------------------------|-------------------|---------------------|-------------------|-------------------|
| | (1) | (2) | | 1/ | |
| Coastal Plains---16-----: | 64 | 5 | 24 | 7 | 100 |
| Coastal Plains---28-----: | 43 | 5 | 47 | 5 | 100 |
| Coastal Plains---32-----: | 45 | 4 | 43 | 8 | 100 |
| Piedmont -----33-----: | 50 | 6 | 21 | 23 | 100 |
| Limestone Valley - 45 -----: | 61 | 6 | 28 | 5 | 100 |
| Clay Hills-----46-----: | 41 | 4 | 49 | 6 | 100 |
| Black Belt -----47-----: | 49 | 6 | 43 | 2 | 100 |
| Brown Loam -----49-----: | 28 | 0 | 72 | 0 | 100 |
| Delta, Miss. -----64-----: | 14 | 4 | 78 | 4 | 100 |
| Delta, La. -----64-----: | 8 | 12 | 74 | 6 | 100 |
| Delta, Ark. -----64-----: | 26 | 8 | 65 | 1 | 100 |
| Gulf Coast : | | | | | |
| Prairie-----65-----: | 48 | 2 | 28 | 22 | 100 |
| Texas Blacklands - 80 -----: | 60 | 2 | 36 | 2 | 100 |
| Lower Rio : | | | | | |
| Grande Valley --- 82 -----: | 15 | 1 | 57 | 27 | 100 |
| Presidio County, Tex. -----89-----: | 10 | 0 | 37. | 53 | 100 |
| Weighted average ----: | 30 | 5 | 57 | 8 | 100 |

1/ Largely carbamates in combination with chlorinated hydrocarbons or organic phosphates.

Estimates were obtained from each farmer of the 5-year average (1957-61) yield of lint on his farm. Each farmer was also asked to estimate the average lint yield on his farm if there was no damage from insects and if production practices, other than insect control, were the same as those he was now following. These estimates are summarized in table 8. According to the estimates, the average yield for 1957-61 was 32 percent lower than it would have been if there had been no damage by insects. Although there might be considerable error in these estimates, they indicate the importance farmers attach to prevention of losses by insects.

FERTILIZER

In all areas except the Gulf Coast Prairie, the Blackland, and the Lower Rio Grande Valley, essentially all of the cotton acreage was fertilized. The rate of application for the total cotton acreage in the areas surveyed averaged 102 pounds of plant nutrients per planted acre. The average cost of fertilizer, including its application, was approximately \$10 per acre (table 9). If the three low-fertilizer-using

Table 8.--Average yield of cotton, per harvested acre, and the estimated yield with no damage by insects, by area

| Area and number | Acres planted to: cotton in 1961 | 1,000 acres | Pounds | | Percent |
|--------------------------------|-------------------------------------|----------------|---|---|---------|
| | | | Estimated yield with no damage by insects | Estimated yield with no damage from potential yield with no insect damage | |
| Coastal Plains----- | 16 ----- | 165 | 384 | 644 | 40 |
| Coastal Plains----- | 28 ----- | 336 | 423 | 641 | 34 |
| Coastal Plains----- | 32 ----- | 285 | 430 | 737 | 42 |
| Piedmont ----- | 33 ----- | 152 | 402 | 635 | 37 |
| Limestone Valley -- | 45 ----- | 277 | 474 | 680 | 30 |
| Clay Hills----- | 46 ----- | 174 | 449 | 661 | 32 |
| Black Belt ----- | 47 ----- | 171 | 363 | 692 | 48 |
| Brown Loam ----- | 49 ----- | 354 | 632 | 756 | 16 |
| Delta, Miss. ----- | 64 ----- | 720 | 514 | 753 | 32 |
| Delta, La. ----- | 64 ----- | 379 | 546 | 836 | 35 |
| Delta, Ark. ----- | 64 ----- | 663 | 573 | 760 | 25 |
| Gulf Coast Prairie - | 65 ----- | 221 | 298 | 414 | 28 |
| Texas Blacklands -- | 80 ----- | 1,178 | 213 | 334 | 36 |
| Lower Rio Grande Valley----- | 82 ----- | 422 | 428 | 673 | 36 |
| Presidio County, Tex. ----- | 89 ----- | 4 | 942 | 1,304 | 28 |
| Total ----- | ----- | 5,501 | ----- | ----- | ----- |
| Weighted average ----- | ----- | 426 | 628 | 32 | |

Table 9.—Percentage of cotton acreage fertilized, average application per planted acre, by size of farm and cost per planted acre, by area, 1961

| Area and number | Acres fertilized | Average application of plant nutrients per planted acre | | | Cost per planted acre | | | |
|--------------------------------------|---------------------|--|--------|--------|-----------------------|---------------------|------------|-------|
| | | Percent | | Pounds | Pounds | ; | | |
| | | Small | Medium | Large | ; | Weighted average | Fertilizer | |
| Coastal Plains-----16-----: | 100 | 15.7 | 164 | 161 | 160 | 13.93 | 2.42 | 16.35 |
| Coastal Plains-----28-----: | 100 | 16.2 | 208 | 224 | 200 | 19.41 | 2.42 | 21.83 |
| Coastal Plains-----32-----: | 100 | 224 | 225 | 235 | 228 | 20.23 | 2.42 | 22.65 |
| Piedmont-----33-----: | 99 | 170 | 196 | 209 | 193 | 17.09 | 2.42 | 19.51 |
| Limestone Valley ---45-----: | 100 | 165 | 175 | 177 | 172 | 13.14 | 1.14 | 14.28 |
| Clay Hills-----46-----: | 100 | 158 | 161 | 171 | 162 | 12.47 | 1.14 | 13.61 |
| Black Belt -----47-----: | 99 | 116 | 128 | 182 | 148 | 11.60 | 1.08 | 12.68 |
| Brown Loam -----49-----: | 99 | 142 | 148 | 184 | 156 | 13.54 | 1.23 | 14.77 |
| Delta, Miss. -----64-----: | 99 | 62 | 75 | 101 | 96 | 8.07 | .59 | 8.66 |
| Delta, La. -----64-----: | 99 | 69 | 86 | 140 | 103 | 11.01 | .60 | 11.61 |
| Delta, Ark. -----64-----: | 99 | 90 | 109 | 170 | 146 | 11.95 | .65 | 12.60 |
| Gulf Coast -----: | | | | | | | | |
| Prairie-----65-----: | 19 | 2 | 6 | 23 | 14 | 1.26 | .12 | 1.38 |
| Texas Blacklands -- 80 -----: | 11 | 1 | 1 | 6 | 4 | .41 | .07 | .48 |
| Lower Rio Grande Valley-----82-----: | 53 | 43 | 44 | 60 | 52 | 5.30 | .32 | 5.62 |
| Presidio County, Tex. -----89-----: | 91 | 100 | 135 | 84 | 104 | 10.23 | .59 | 10.82 |
| Weighted average -----: | --- | --- | --- | --- | 102 | 9.22 | .86 | 10.08 |

areas mentioned above are excluded, the average for the remaining areas is 144 pounds of plant nutrients and a cost of slightly over \$14 per planted acre.

The highest rates of application occurred in the Southeastern areas, where mixed fertilizers account for much of the total. For example, in the Coastal Plains areas of Alabama and Georgia, Area 32, the composition of total plant nutrients is as follows: 73 pounds of nitrogen, 65 pounds of P₂O₅, and 89 pounds of K₂O, compared with the Delta area of Mississippi where nitrogen, largely in anhydrous ammonia, is essentially the only nutrient applied.

In general, operators of large farms used more fertilizer per acre than operators of small and medium-sized farms.

HERBICIDES

The use of herbicides for the control of grass and weeds in cotton is of considerable importance in several areas included in the survey.

Pre-emergence

The use of pre-emergence herbicides varied considerably among areas and by size of farm, ranging from 77 percent of the acreage on large farms in the Delta area of Louisiana to none in the four Texas areas (table 10). The average cost, including application, was slightly over \$3 per acre treated. This is equivalent to slightly over \$1 per planted acre.

Post-emergence

The use of post-emergence herbicides was confined almost exclusively to the Delta areas and primarily to large farms in these areas. On the three Delta areas, approximately one-sixth of the planted acreage was treated at an average cost of slightly over \$3 per acre (including application).

DEFOLIANTS

Occasionally, chemical defoliants are used to remove excessive vegetation to prevent the rotting of bolls near the base of the plant, even though harvesting is done by hand. However, the main purpose of their use is to facilitate the mechanical harvesting process. Thus, there is a close relationship between the extent of mechanical harvesting and the use of chemical defoliants.

In the Delta areas, the Blackland area, and the Lower Rio Grande Valley, a relatively high proportion of the cotton acreage is treated with defoliants. A high proportion of the cotton is harvested mechanically in these areas. In the Piedmont area, a very small percentage of the cotton is harvested mechanically and essentially no chemical defoliants are used.

About two-fifths of the cotton acreage in the survey areas was defoliated. The cost of materials and their application averaged about \$2.50 per acre treated. This is equivalent to about \$1 per planted acre (table 11).

Table 10.--Percentage of cotton acres treated with pre-emergence herbicide, by size of farm and average cost per acre, by area, 1961

| Area and number | Planted acres treated | | | Cost per acre treated | | | 'Total cost per planted acre | |
|---------------------------------------|-----------------------|--------|---------------------|-----------------------|-------------|-------|---------------------------------------|--|
| | Size of farm | | Weighted average | Material. | Application | Total | | |
| | Small | Medium | | | | | | |
| Coastal Plains-----16----- | 3 | 11 | 8 | 5.25 | 0.21 | 5.46 | 0.40 | |
| Coastal Plains-----28----- | 1 | 4 | 15 | 4.53 | .21 | 4.74 | .66 | |
| Coastal Plains-----32----- | 4 | 7 | 25 | 11 | 3.36 | .21 | 3.57 | |
| Piedmont -----33----- | 2 | 7 | 24 | 12 | 2.30 | .21 | 2.51 | |
| Limestone Valley--45----- | 10 | 26 | 33 | 23 | 2.50 | .64 | 3.14 | |
| Clay Hills-----46----- | 19 | 37 | 69 | 38 | 3.07 | .45 | 3.52 | |
| Black Belt -----47----- | 3 | 6 | 34 | 17 | 3.20 | .24 | 3.43 | |
| Brown Loam -----49----- | 24 | 38 | 71 | 43 | 2.25 | .51 | 2.72 | |
| Delta, Miss. -----64----- | 15 | 42 | 62 | 58 | 3.24 | .23 | 3.47 | |
| Delta, La. -----64----- | 16 | 52 | 77 | 54 | 2.34 | .23 | 2.57 | |
| Delta, Ark. -----64----- | 12 | 24 | 46 | 37 | 2.37 | .23 | 2.60 | |
| Gulf Coast | | | | | | | | |
| Prairie-----65----- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Texas Blacklands -- 80 ----- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Lower Rio | | | | | | | | |
| Grande Valley -----82----- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Presidio County, Tex. -----89----- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Weighted average ---- | --- | --- | 35 | 2.83 | .28 | 3.11 | 1.08 | |

Table 11.--Percentage of acres treated with defoliants and average cost per acre, by area, 1961

| Area and number | Acres treated | Cost per treated acre | | | Total cost per planted acre | |
|--------------------------|------------------|-----------------------|-------------|---------|--------------------------------------|------|
| | | Material | Application | Total | | |
| | | Percent | Dollars | Dollars | | |
| Coastal Plains----- | 16 -----: | 33 | 2.35 | 0.62 | 2.97 | 0.99 |
| Coastal Plains----- | 28 -----: | 22 | 2.71 | .62 | 3.33 | .75 |
| Coastal Plains----- | 32 -----: | 30 | 2.55 | .54 | 3.09 | .92 |
| Piedmont ----- | 33 -----: | 4 | 2.62 | .71 | 3.33 | .14 |
| Limestone Valley -- | 45 -----: | 9 | 2.13 | 1.09 | 3.22 | .28 |
| Clay Hills----- | 46 -----: | 15 | 1.76 | .91 | 2.67 | .41 |
| Black Belt ----- | 47 -----: | 9 | 4.89 | .85 | 5.74 | .54 |
| Brown Loam ----- | 49 -----: | 10 | 2.37 | 1.44 | 3.81 | .37 |
| Delta, Miss. ----- | 64 -----: | 68 | 1.78 | .91 | 2.69 | 1.84 |
| Delta, La. ----- | 64 -----: | 48 | 1.85 | .94 | 2.79 | 1.34 |
| Delta, Ark. ----- | 64 -----: | 53 | 1.35 | .95 | 2.30 | 1.21 |
| Gulf Coast | : | | | | | |
| Prairie----- | 65 -----: | 26 | 2.13 | .79 | 2.93 | .75 |
| Texas Blacklands -- | 80 -----: | 54 | .84 | .84 | 1.68 | .90 |
| Lower Rio | : | | | | | |
| Grande Valley ----- | 82 -----: | 49 | 2.12 | .90 | 3.02 | 1.49 |
| Presidio County, Tex. | -----: | | | | | |
| ----- | 89 -----: | 16 | 2.49 | .90 | 3.39 | .52 |
| Weighted average --- | 41 | 1.61 | .87 | 2.48 | 1.01 | |

COST OF CHEMICALS

A summary of the costs of specified chemicals used in producing cotton is shown in table 12. The estimated weighted average cost per acre planted was \$17.74 for the chemicals plus about \$5.30 for their application. The average yield of lint was about 410 pounds per acre in 1961. Thus, the cost averaged about 5.6 cents per pound of lint.

The estimated acreage of cotton in the survey areas was about 5.5 million acres. The estimated total cost of these chemicals was approximately \$97.5 million and the total including application nearly \$127 million.

Some chemicals were used to treat cotton seed and others to fumigate the soil on which cotton was to be planted. Estimates of the costs of these items were not available. However, it is believed that they were relatively small. Thus, the estimates shown above can be considered as rough approximations of total costs of chemicals used on cotton in the survey areas.

Table 12--Cost of chemicals used in cotton production, per planted acre, by selected area, 1961

| Area and number | Insecticides | Fertilizer | Herbicides | Defoliants | Total |
|--------------------------------------|--------------|------------|------------|------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars | Dollars |
| Coastal Plains----16 -: | 5.88 | | 13.93 | 0.42 | 0.78 | | | | | 21.01 | | 26.17 |
| Coastal Plains----28 -: | 8.52 | | 19.41 | .70 | .60 | | | | | 29.23 | | 35.06 |
| Coastal Plains----32 -: | 13.40 | | 20.23 | .37 | .77 | | | | | 34.77 | | 42.55 |
| Piedmont -----33 -: | 10.63 | | 17.09 | .28 | .10 | | | | | 28.10 | | 33.54 |
| Limestone Valley - 45 -: | 5.22 | | 13.14 | .58 | .19 | | | | | 19.13 | | 23.01 |
| Clay Hills-----46 -: | 7.43 | | 12.47 | 1.19 | .26 | | | | | 21.35 | | 27.25 |
| Black Belt -----47 -: | 6.08 | | 11.60 | .54 | .44 | | | | | 18.66 | | 22.71 |
| Brown Loam -----49 -: | 1.69 | | 13.54 | .97 | .24 | | | | | 16.44 | | 19.54 |
| Delta, Miss. -----64 -: | 8.07 | | 8.07 | 2.07 | 1.21 | | | | | 19.42 | | 26.64 |
| Delta, La. -----64 -: | 7.95 | | 11.01 | 1.56 | .89 | | | | | 21.41 | | 31.14 |
| Delta, Ark. -----64 -: | 4.35 | | 11.95 | 1.63 | .72 | | | | | 18.65 | | 23.41 |
| Gulf Coast | | | | | | | | | | | | |
| Prairie-----65 -: | 3.49 | | 1.26 | 0 | .55 | | | | | 5.30 | | 8.27 |
| Texas Blacklands - 80 -: | 2.83 | | .41 | 0 | .45 | | | | | 3.69 | | 6.11 |
| Lower Rio | | | | | | | | | | | | |
| Grande Valley --- 82 -: | 15.33 | | 5.30 | 0 | 1.04 | | | | | 21.67 | | 28.57 |
| Presidio County, Tex. ----- 89 -: | 29.63 | | 10.23 | 0 | .40 | | | | | 40.26 | | 50.12 |
| Weighted average--: | 6.56 | | 9.22 | 1.30 | .66 | | | | | 17.74 | | 23.04 |

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